

the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

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What is claimed is:

1. An apparatus for controlling recording and reproducing in a video cassette tape recorder comprising:

frame extracting means for buffering compressed digital data input thereto, and extracting specific data for a speed-varied reproduction from said compressed digital data;

frame recording position controlling means for calculating a number of tracks for recording the compressed digital data and selectively outputting a buffered output, said extracted specific data from said frame extracting means, and a multiplexing timing signal;

frame position information recording means for recording position information of specific tracks for the speed-varied reproduction and index information on a magnetic tape, based on said multiplexing timing signal;

digital recording means for recording digital signals including said digital data and said index information on said magnetic tape;

digital reproduction means for reproducing the digital signals recorded on the magnetic tape;

frame position information detecting means for detecting said position information of the specific tracks for the speed-varied reproducing and said index information;

tape speed controlling means for controlling the speed of a capstan motor, based on said detected index information and said position information of the specific tracks; and

frame removing means for receiving an output from the digital reproduction means and removing unnecessary bit streams from the specific data.

2. An apparatus in accordance with claim 1, wherein said frame extracting means comprises:

an interface for receiving said compressed digital data;  
a buffer for buffering an output of said interface for a predetermined period;

a frame detector for detecting said specific data from said output of the interface and outputting a write enable signal; and

a frame memory for selecting and storing the detected specific data, based on said write enable signal.

3. An apparatus in accordance with claim 2, wherein said frame detector counts a number of frames when a frame mark code is detected from a bit stream of said output of the interface, and enables said write enable signal when said counted number of frames is determined to be the same as an interval number at which I-frames are present.

4. An apparatus in accordance with claim 1, wherein said frame recording position controlling means comprises:

a track number calculator for calculating an average bit rate of said compressed digital data, the size of the specific data, a number of tracks for recording said specific data and a number of tracks present between said specific tracks;

a multiplexing timing generator for receiving an output from said track number calculator and outputting a switching signal for positioning the specific data on said specific tracks in accordance with a head switching signal;

a multiplexer for selecting an output from said frame extracting means, based on an output from said multi-

plexing timing generator and sending said selected output to said digital recording means; and  
a bit stuffing circuit for filling insufficient data with bit streams or dummy bits when said selected output of the frame extracting means is at an underflow state.

5. An apparatus in accordance with claim 1, wherein said frame position information recording means comprises:

a frame position recorder for receiving an output from said frame recording position controlling means and outputting position discrimination information to said digital recording means so as to record position information of a next specific track on an initial synchronous block of a track having said specific data recorded thereon; and

an index signal recorder for recording position information of said track having said specific data recorded thereon on a control track of said magnetic tape by an index head.

6. An apparatus in accordance with claim 1, wherein said frame position information detecting means comprises:

an index signal detector for detecting index information recorded on a control track of said magnetic tape, said index information indicating whether tracks recorded with said specific data are present;

a recording position-synchronized block detector for detecting an output from said digital reproduction means and detecting recording position-synchronized blocks recorded with codes indicative of relative position information of said tracks recorded with said specific data; and

a recording position decoder for decoding an output of said recording position-synchronized block detector, based on a number of different tape speeds, and thereby outputting a signal for calculating a capstan servo speed.

7. An apparatus in accordance with claim 1, wherein said tape speed controlling means comprises:

a capstan servo speed calculator for calculating a capstan servo speed for repeating a normal speed travel on said specific tracks and a high speed travel on tracks between adjacent specific tracks in a speed-varied reproduction by using the position information of the specific track from said frame position information detecting means based on a number of different tape speeds; and

a capstan servo drive signal generator for controlling driving of said capstan motor, based on an output of said capstan servo speed calculator.

8. An apparatus in accordance with claim 1, wherein said frame removing means comprises:

a deformatter for converting an output of said digital reproduction means to a signal form prior to recording;

a stuffing bit-detecting and removing circuit for outputting a bit removing signal to said deformatter and removing stuffing bits or dummy bits added for preventing generation of an underflow of said frame extracting means in the speed-varied reproduction; and

a frame removal timing generator for receiving said position information of the specific tracks from said frame position information detecting means and outputting a frame removing signal to the deformatter, based on a head switching signal, thereby preventing outputting of said specific data in a normal-speed reproduction.

9. An apparatus in accordance with claim 1, wherein said specific data includes I-frames.

10. An apparatus in accordance with claim 1, wherein said digital recording means and said digital reproduction means include a plurality of heads and switches for selectively recording and reproducing the digital signals.

11. An apparatus for controlling recording in a video cassette tape recorder comprising:

frame extracting means for receiving compressed digital data input thereto and extracting specific data for a speed-varied reproduction from said compressed digital data;

frame recording position controlling means for generating a multiplexing timing signal and multiplexing said compressed digital data and said extracted specific data from said frame extracting means based on said multiplexing timing signal;

frame position information recording means for recording index information and position information of specific tracks for recording said specific data for the speed-varied reproduction on a magnetic tape based on said multiplexing timing signal; and

digital recording means for recording digital signals including said digital data and specific data from said frame recording position controlling means on the magnetic tape.

12. An apparatus in accordance with claim 11, wherein said frame extracting means includes:

an interface for receiving said compressed digital data; a buffer for buffering an output of said interface for a predetermined period;

a frame detector for detecting said specific data from said output of the interface and outputting a write enable signal; and

a frame memory for selecting and storing said specific data based on said write enable signal.

13. An apparatus in accordance with claim 12, wherein said frame detector starts counting frames when a frame mark code is detected from a bit stream of said output of the interface, and enables said write enable signal when said counted frame number equals an interval number at which I-frames are present.

14. An apparatus in accordance with claim 11, wherein said frame recording position controlling means includes:

a track number calculator for calculating a number of said specific tracks for recording said specific data and a number of tracks present between said specific tracks;

a multiplexing timing generator for generating said multiplexing timing signal based on an output from said track number calculator; and

a multiplexer for selecting an output from said frame extracting means based on said generated multiplexing timing signal.

15. An apparatus in accordance with claim 14, wherein said frame recording position controlling means includes a bit stuffing circuit for filling insufficient data with bit streams or dummy bits when said selected output of the frame extracting means is at an underflow state.

16. An apparatus in accordance with claim 11, wherein said frame position information recording means includes:

a frame position recorder for receiving an output from said frame recording position controlling means and outputting position discrimination information to said digital recording means so as to record said position information of said specific tracks; and

an index signal recorder for recording said index information on a control track of the magnetic tape, said

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index information including information indicating whether said specific tracks for said specific data are present.

17. An apparatus in accordance with claim 11, wherein said specific data includes I-frames, and said digital recording means includes a plurality of heads and switches for selectively recording said digital signals.

18. An apparatus in accordance with claim 11, wherein said digital recording means includes an interleaving and channel driving circuit, a plurality recording formatters, and a plurality of channel modulators, for formatting said digital signals so as to record said digital signals on the magnetic tape.

19. A method for controlling recording and reproduction in a video cassette tape recorder, comprising the steps of:

extracting specific data for a speed varied reproduction from compressed digital data;

calculating a number of tracks for recording said digital data and outputting a multiplexing timing signal based on said calculated number of tracks;

recording position information of specific tracks for the speed varied reproduction and index information on a magnetic tape based on said multiplexing timing signal;

recording digital signals including said digital data and said index information on the magnetic tape;

reproducing said digital signals recorded on the magnetic tape;

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detecting said position information of the specific tracks  
for the speed varied reproduction and said index information;

controlling the speed of a capstan motor based on said  
detected index information and position information of  
the specific tracks; and

removing unnecessary bit streams from said specific data.

20. A method in accordance with claim 19, wherein said  
specific data includes I-frames.

21. A method of controlling recording in a video cassette  
tape recorder, comprising the steps of:

extracting specific data for a speed-varied reproduction  
from compressed digital data;

generating a multiplexing timing signal and multiplexing  
said compressed digital data and said extracted specific  
data based on said multiplexing timing signal;

recording index information and position information of  
specific tracks for recording said specific data for the  
speed-varied reproduction on a magnetic tape based on  
said multiplexing timing signal; and

recording digital signals including said multiplexed digital  
data and specific data on the magnetic tape.

22. A method in accordance with claim 21, wherein said  
generating step includes calculating a number of tracks for  
recording said digital data and generating said multiplexing  
timing signal based on said calculated number of tracks.

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*Sub A*

23. An apparatus for controlling recording in a digital recording device, comprising:  
an input unit receiving digital video data;  
a detection circuit coupled to the input unit and detecting specific data from the received digital video data;  
a data generating circuit coupled to the detection circuit and generating a plurality of relative position data, each of the plurality of relative position data indicative of a plurality of relative positions from a current specific data location to each of a plurality of consecutive specific data locations; and  
a recording unit coupled to the data generating circuit and recording the digital video data, the detected specific data, and the plurality of relative position data on a digital medium.

*Sub B2*

24. The apparatus of claim 23, wherein the specific data is I-frame data.

*Sub A*

25. The apparatus of claim 23, wherein the data generating circuit includes:  
a timing signal generating circuit generating a timing control signal; and  
a multiplexer coupled the timing signal generating circuit and selectively outputting the detected specific data and the digital video data based on the timing control signal.

*Sub F3*

26. The apparatus of claim 23, wherein the digital medium includes a magnetic medium.

*Sub C2*

27. The apparatus of claim 23, wherein each of the plurality of relative position data includes a plurality of distance indicators, each distance indicator indicating a distance between the current specific data location and one of the consecutive specific data locations.

28. The apparatus of claim 27, wherein said distance is represented with a number of distance units present between the current specific data location and one of the consecutive specific data locations.

*Sub E5*

29. The apparatus of claim 28, wherein the distance unit is a track on the storage medium.

*Sub B3*

30. The apparatus of claim 23, wherein the recording unit includes:  
a formatting circuit coupled to the detection circuit and forming a synchronous block including one of the plurality of relative position data therein for each video data region.

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~~31. The apparatus of claim 30, wherein the video data regions are I-frame data regions.~~

~~32. The apparatus of claim 31, wherein the recording unit records the synchronous block on the digital medium for each I-frame data region.~~

~~33. An apparatus for controlling reproduction in a digital reproducing device, comprising:~~

~~a reproducing unit reproducing digital data stored on a digital medium, the digital data including a plurality of specific data and a plurality of relative position data, each relative position data indicative of a plurality of relative positions from a current specific data location to each of a plurality of consecutive specific data locations;~~

~~a detection circuit coupled to the reproducing unit and detecting one of the plurality of relative position data from the reproduced digital data; and~~

~~a control circuit coupled to the detection circuit, receiving a variable-speed command and controlling the reproducing unit to reproduce at least another specific data based on the detected relative position data and the variable-speed command.~~

~~34. The apparatus of claim 33, wherein the detection circuit includes:~~

~~a decoding circuit selecting one of the relative positions represented in said detected relative position data based on the variable-speed command.~~

~~35. The apparatus of claim 33, wherein the specific data is I-frame data.~~

~~36. The apparatus of claim 33, wherein each of the plurality of relative position data includes a plurality of distance indicators, each distance indicator indicating a distance between the current specific data location and one of the consecutive specific data locations.~~

~~37. The apparatus of claim 36, wherein said distance is represented with a number of distance units present between the current specific data location and one of the consecutive specific data locations.~~

~~38. The apparatus of claim 37, wherein the distance unit is a track on the digital medium.~~

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*Sub A4*  
39. The apparatus of claim 33, wherein the reproducing unit includes a motor for moving the digital medium.

40. The apparatus of claim 39, wherein the control circuit includes:  
a calculating circuit calculating a rotational speed of the motor based on the detected relative position data.

41. The apparatus of claim 33, wherein the reproducing unit includes reading heads and signal processing circuits.

42. A method for controlling recording in a digital recording device, comprising the steps of:  
receiving digital video data;  
detecting specific data from the received digital video data;  
generating a plurality of relative position data, each of the plurality of relative position data indicative of a plurality of relative positions from a current specific data location to each of a plurality of consecutive specific data locations; and  
recording the digital video data, the detected specific data, and the plurality of relative position data on a digital medium.

*Sub B8*  
43. The method of claim 42, wherein in said detecting step, the specific data is I-frame data.

44. The method of claim 42, further comprising the step of:  
generating a timing control signal; and  
wherein said recording step includes,  
recording the digital video data and the detected specific data based on the timing control signal.

*Sub C6*  
45. The method of claim 42, wherein in said recording step, the digital medium includes a magnetic medium.

*Sub C6*  
46. The method of claim 42, wherein each of the plurality of relative position data includes a plurality of distance indicators, each distance indicator indicating a distance between the current specific data location and one of the consecutive specific data locations.

~~47. The method of claim 46, wherein said distance is represented with a number of distance units present between the current specific data location and one of the consecutive specific data locations.~~

~~48. The method of claim 47, wherein the distance unit is a track on the digital medium.~~

~~49. The method of claim 42, wherein said recording step includes the step of:  
forming a synchronous block including one of the plurality of relative position data  
therein for each video data region.~~

~~50. The method of claim 49, wherein in said forming step, the video data regions are I-frame  
data regions.~~

~~51. The method of claim 50, wherein said recording step includes the step of recording the  
synchronous block on the digital medium for each I-frame data region.~~

~~52. A method for controlling reproduction in a digital reproducing device, comprising the  
steps of:~~

~~reproducing digital data stored on a digital medium, the digital data including a  
plurality of specific data and a plurality of relative position data, each relative position data  
indicative of a plurality of relative positions from a current specific data location to each of a  
plurality of consecutive specific data locations;~~

~~detecting one of the plurality of relative position data from the reproduced digital  
data;~~

~~receiving a variable-speed command; and~~

~~reproducing at least another specific data based on the detected relative position data  
and the variable-speed command.~~

~~53. The method of claim 52, wherein said reproducing step includes the step of:~~

~~decoding the detected relative position data by selecting one of the relative positions  
represented in the detected relative position data based on the variable-speed command to  
reproduce the at least another specific data.~~

*Sub B11*

54. The method of claim 52, wherein the specific data is I-frame data.

*Sub C8*

55. The method of claim 52, wherein each of the plurality of relative position data includes a plurality of distance indicators, each distance indicator indicating a distance between the current specific data location and one of the consecutive specific data locations.

56. The method of claim 55, wherein said distance is represented with a number of distance units present between the current specific data location and one of the consecutive specific data locations.

*Sub E9*

57. The method of claim 56, wherein the distance unit is a track on the digital medium.

58. The method of claim 52, wherein said reproducing step includes the step of:  
calculating a rotational speed of a motor for moving the digital medium based on the detected relative position data.

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